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PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application of

Kazumasa HASEGAWA et al.

Application No.: 09/934,550

Filed: August 23, 2001

Docket No.: 110450

For: FERROELECTRIC MEMORY DEVICE, METHOD OF
MANUFACTURING THE SAME, AND EMBEDDED DEVICE

PRELIMINARY AMENDMENT

Director of the U.S. Patent and Trademark Office
Washington, D. C. 20231

Sir:

Prior to initial examination, please amend the above-identified application as follows:

IN THE SPECIFICATION:

Page 2, line 25 to page 3, line 4, delete current paragraph and insert therefor:

(1) The ferroelectric layer may be disposed linearly along the first signal electrodes. Specifically, the ferroelectric layer may be selectively disposed over the first signal electrodes. In this case, since the ferroelectric layer is formed linearly along the first signal electrodes, the parasitic capacitance or load capacitance of the second signal electrodes can be decreased.

Page 3, line 22 to page 4, line 1, delete current paragraph and insert therefor:

(2) The ferroelectric layer may be disposed linearly along the second signal electrodes. Specifically, the ferroelectric layer may be selectively disposed under the second signal electrodes. In this case, since the ferroelectric layer is formed linearly along the

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second signal electrodes, the parasitic capacitance or load capacitance of the first signal electrodes can be decreased.

Page 4, lines 9-14, delete current paragraph and insert therefor:

(3) The ferroelectric layer may be disposed only in the intersection regions between the first signal electrodes and the second signal electrodes. In this case, since the ferroelectric layer is formed in the smallest region, the parasitic capacitance or load capacitance of the signal electrodes can be further decreased.

Page 11, lines 6-9, delete current paragraph and insert therefor:

The method may comprise a step (b-5) of forming insulation layers between the first signal electrodes after the step (b-1), and

upper surfaces of the insulation layers may be on the same level as upper surfaces of the first signal electrodes.

Page 20, line 25 to page 21, line 5, delete current paragraph and insert therefor:

The ferroelectric memory device according to the second embodiment differs from the first embodiment in that the ferroelectric layer 14 is formed linearly along the second signal electrodes 16. The parasitic capacitance or load capacitance of the first signal electrodes 12 can be decreased by forming the ferroelectric layer 14 linearly. The linear ferroelectric layer 14 may be formed by patterning using a mask used to pattern the second signal electrodes 16 as described later.

Page 21, lines 6-18, delete current paragraph and insert therefor:

A dielectric layer 18 is formed between laminates consisting of the ferroelectric layer 14 and the second signal electrode 16 so as to cover exposed areas of the base 10 and the first signal electrodes 12. The dielectric layer 18 preferably has a dielectric constant lower than

that of the ferroelectric layer 14. The parasitic capacitance or load capacitance of the second signal electrodes 16 can be decreased by allowing the dielectric layer 18 having a dielectric constant lower than that of the ferroelectric layer 14 to be interposed between the laminates consisting of the ferroelectric layer 14 and the second signal electrode 16. As a result, a read or write operation of the ferroelectric memory device 1000 can be performed at a higher speed.

Page 27, lines 1-13, delete current paragraph and insert therefor:

The ferroelectric layer 14 is selectively formed on the first signal electrodes 12. Surface-modifying layer 22 is formed on the base 10 between the first signal electrodes 12. The dielectric layer 18 is formed on the surface-modifying layer 22. The dielectric layer 18 preferably has a dielectric constant lower than that of the ferroelectric layer 14. The parasitic capacitance or load capacitance of the second signal electrodes 16 can be decreased by allowing the dielectric layer 18 having a dielectric constant lower than that of the ferroelectric layer 14 to be interposed between laminates consisting of the first signal electrode 12 and the ferroelectric layer 14. As a result, read or write operations of the ferroelectric memory device can be performed at a higher speed.

Page 41, lines 7-18, delete current paragraph and insert therefor:

The dielectric layer 180 and the dielectric layer which is optionally formed preferably have a dielectric constant lower than that of the ferroelectric layer 14. The parasitic capacitance or load capacitance of the first signal electrodes 12 and the second signal electrodes 16 can be decreased by allowing the dielectric layer having a dielectric constant lower than that of the ferroelectric layer 14 to be interposed between the laminates consisting of the first signal electrode 12 and the ferroelectric layer 14 and between the laminates consisting of the ferroelectric layer 14 and the second signal electrode 16. As a result, a read or write operation of the ferroelectric memory device can be performed at a higher speed.

Page 41, lines 19-25, delete current paragraph and insert therefor:

In the present embodiment, the ferroelectric layer 14 which makes up the ferroelectric capacitors 20 are formed only in the intersection regions between the first signal electrodes 12 and the second signal electrodes 16. According to this configuration, the parasitic capacitance or load capacitance of both the first signal electrodes 12 and the second signal electrodes 16 can be decreased.

IN THE CLAIMS:

Please replace claims 35-37, 47 and 49 as follows:

35. (Amended) The method of manufacturing a ferroelectric memory device according to claim 34,
wherein the ferroelectric layer and the second signal electrodes are patterned by etching using the same mask.

36. (Amended) The method of manufacturing a ferroelectric memory device according to claim 34,
wherein a dielectric layer is provided between laminates formed of the ferroelectric layer and the second signal electrode so as to cover exposed areas of the base and the first signal electrodes.

37. (Amended) The method of manufacturing a ferroelectric memory device according to claim 36,
wherein the dielectric layer is formed of a material having a dielectric constant lower than a dielectric constant of the ferroelectric layer.

47. (Amended) The method of manufacturing a ferroelectric memory device according to claim 24, further comprising:

a step (b-5) of forming insulation layers between the first signal electrodes after the step (b-1),

wherein upper surfaces of the insulation layers are on the same level as upper surfaces of the first signal electrodes.

49. (Amended) An embedded device comprising:
the ferroelectric memory device as defined in claim 1; and
at least one component selected from a group including a flash memory, a processor, an analog circuit, and an SRAM.

REMARKS

Claims 1-49 are pending. By this Preliminary Amendment, the specification and claims 35-37, 47 and 49 are amended. No new matter is added.

The attached Appendix includes marked-up copies of each rewritten paragraph (37 C.F.R. §1.121(b)(1)(iii)) and claim (37 C.F.R. §1.121(c)(1)(ii)).

Prompt and favorable examination on the merits is respectfully requested.

Respectfully submitted,



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APPENDIX

Changes to Specification:

Page 2, line 25 to page 3, line 4:

(1) The ferroelectric layer may be disposed linearly along the first signal electrodes. Specifically, the ferroelectric layer may be selectively disposed over the first signal electrodes. In this case, since the ferroelectric layer is formed linearly along the first signal electrodes, the parasitic capacitance or load capacitance of the second signal electrodes can be decreased.

Page 3, line 22 to page 4, line 1:

(2) The ferroelectric layer may be disposed linearly along the second signal electrodes. Specifically, the ferroelectric layer may be selectively disposed under the second signal electrodes. In this case, since the ferroelectric layer is formed linearly along the second signal electrodes, the parasitic capacitance or load capacitance of the first signal electrodes can be decreased.

Page 4, lines 9-14:

(3) The ferroelectric layer may be disposed only in the intersection regions between the first signal electrodes and the second signal electrodes. In this case, since the ferroelectric layer is formed in the smallest region, the parasitic capacitance or load capacitance of the signal electrodes can be further decreased.

Page 11, lines 6-9:

The method may comprise a step (b-5) of forming insulation layers between the first signal electrodes after the step (b-1), and

upper surfaces of the insulation layers may be on the same level as upper surfaces of the first signal electrodes.

Page 20, line 25 to page 21, line 5:

The ferroelectric memory device according to the second embodiment differs from the first embodiment in that the ferroelectric layer 14 is formed linearly along the second signal electrodes 16. The parasitic capacitance or load capacitance of the first signal electrodes 12 can be decreased by forming the ferroelectric layer 14 linearly. The linear ferroelectric layer 14 may be formed by patterning using a mask used to pattern the second signal electrodes 16 as described later.

Page 21, lines 6-18:

A dielectric layer 18 is formed between laminates consisting of the ferroelectric layer 14 and the second signal electrode 16 so as to cover exposed areas of the base 10 and the first signal electrodes 12. The dielectric layer 18 preferably has a dielectric constant lower than that of the ferroelectric layer 14. The parasitic capacitance or load capacitance of the second signal electrodes 16 can be decreased by allowing the dielectric layer 18 having a dielectric constant lower than that of the ferroelectric layer 14 to be interposed between the laminates consisting of the ferroelectric layer 14 and the second signal electrode 16. As a result, a read or write operation of the ferroelectric memory device 1000 can be performed at a higher speed.

Page 27, lines 1-13:

The ferroelectric layer 14 is selectively formed on the first signal electrodes 12. Surface-modifying layer 22 is formed on the base 10 between the first signal electrodes 12. The dielectric layer 18 is formed on the surface-modifying layer 22. The dielectric layer 18 preferably has a dielectric constant lower than that of the ferroelectric layer 14. The parasitic capacitance or load capacitance of the second signal electrodes 16 can be decreased by allowing the dielectric layer 18 having a dielectric constant lower than that of the ferroelectric layer 14 to be interposed between laminates consisting of the first signal electrode 12 and the

ferroelectric layer 14. As a result, read or write operations of the ferroelectric memory device can be performed at a higher speed.

Page 41, lines 7-18:

The dielectric layer 180 and the dielectric layer which is optionally formed preferably have a dielectric constant lower than that of the ferroelectric layer 14. The parasitic capacitance or load capacitance of the first signal electrodes 12 and the second signal electrodes 16 can be decreased by allowing the dielectric layer having a dielectric constant lower than that of the ferroelectric layer 14 to be interposed between the laminates consisting of the first signal electrode 12 and the ferroelectric layer 14 and between the laminates consisting of the ferroelectric layer 14 and the second signal electrode 16. As a result, a read or write operation of the ferroelectric memory device can be performed at a higher speed.

Page 41, lines 19-25:

In the present embodiment, the ferroelectric layer 14 which makes up the ferroelectric capacitors 20 are formed only in the intersection regions between the first signal electrodes 12 and the second signal electrodes 16. According to this configuration, the parasitic capacitance or load capacitance of both the first signal electrodes 12 and the second signal electrodes 16 can be decreased.

Changes to Claims:

The following are marked-up versions of the amended claims:

35. (Amended) The method of manufacturing a ferroelectric memory ~~cell-~~
~~array~~device according to claim 34,

wherein the ferroelectric layer and the second signal electrodes are patterned by etching using the same mask.

36. (Amended) The method of manufacturing a ferroelectric memory ~~cell-~~
~~arraydevice~~ according to claim 34,

wherein a dielectric layer is provided between laminates formed of the
ferroelectric layer and the second signal electrode so as to cover exposed areas of the base
and the first signal electrodes.

37. (Amended) The method of manufacturing a ferroelectric memory ~~cell-~~
~~arraydevice~~ according to claim 36,

wherein the dielectric layer is formed of a material having a dielectric constant
lower than a dielectric constant of the ferroelectric layer.

47. (Amended) The method of manufacturing a ferroelectric memory device
according to claim 24, further comprising:

a step (b-5) of forming insulation layers between the first signal electrodes
after the step (b-1),

wherein upper surfaces of the insulation layers are on the same level as upper
surfaces of the first signal electrodes.

49. (Amended) An embedded device comprising:

the ferroelectric memory device as defined in ~~any one of~~ claims 1 to 23; and

at least one component selected from a group including a flash memory, a
processor, an analog circuit, and an SRAM.